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ABSTRACT

One of a series of papers describing a collaborative educational change effort involving the Jefferson County, Colorado Public Schools, and the Texas Research and Development Center, this paper describes the district-wide revision of a science curriculum, grades 3-6. Results are reported of the monitoring over three years of a representative sample of teachers to determine the effect of implementation of the curriculum, and the effects of the implementation on teachers' concerns, on their levels of use, and on the use of curriculum-specific components in the classroom. Additionally, implications are drawn from the results of the extensive data gathering from this science implementation effort. (CS)

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IMPLEMENTATION OF A DISTRICT-WIDE SCIENCE CURRICULUM: THE EFFECTS OF A THREE YEAR EFFORT

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Paper presented at the annual meeting of the American Educational Research Association, Boston, April, 1980

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IMPLEMENTATION OF A DISTRICT-WIDE SCIENCE CURRICULUM: THE EFFECTS OF A THREE YEAR EFFORT[1,2]

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The literature abounds with case studies and research reports describing educational change efforts that have "failed" (Berman & McLaughlin, 1975; Charters & Jones, 1973; Goodlad & Associates, 1970; Loucks & Hall, 1979; Schiffer, 1978). Many reasons for this have been suggested: individuals' needs were not addressed; context factors were not taken into consideration; programs were not suited to school needs; not enough time nor funds were allotted. As more and more is learned about the process of change, however, the prospects for effective school improvement become greater.

This paper is one of a series[2] which describes a change effort that succeeded. The effort was designed to take into account what is currently known about successful change, and then to report the effects of the change on schools, teachers and students. The Jefferson County, Colorado Public Schools, a suburban school district which serves 80,000 students, responded to teachers'

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[1]The research described herein was conducted under contract with the National Institute of Education. The opinions expressed are those of the authors and do not necessarily reflect the position or policy of the National Institute of Education. No endorsement by the National Institute of Education should be inferred.

[2]The context and implementation design are detailed in Pratt, Melle, Metzdorf and Loucks (1980). Case study analyses of differences in implementation between various schools are reported by Hall, Hord and Griffin (1980). The effects of the implemented program on students are described by Pratt, Winters and George (1980).

needs by developing a revision of their science curriculum for grades 3-6. Jeffco designed an implementation effort collaboratively with research staff of the Texas Research and Development Center, using the Concerns-Based Adoption Model as a framework. Hopefully, the effort will be the first of many that combine research knowledge with practitioner know-how which may turn the tide of failure in school improvement.

For three years, a representative sample of teachers were monitored to determine the effect of implementation on their concerns and on their general use of the curriculum. For two years, use of the program components by teachers in their classrooms was measured. This paper describes results of these assessments. The paper: (1) briefly describes the implementation design; (2) reports on the effects of the implementation on teachers' concerns, on their Levels of Use, and on their use of curriculum-specific components in the classroom; and (3) draws implications from the findings through a dialogue between researcher and practitioner, the co-authors of the paper.

The Implementation Design

Briefly, the revised curriculum combined a "hands-on," inquiry approach to science instruction with behavioral objectives and assessment techniques. The new teacher's guide included all necessary procedures, references to materials and equipment, and any accompanying worksheets.

The eighty elementary schools in the district were divided into three groups, each beginning implementation at roughly six-month intervals, thus known as either Phase I, II, or III schools. The plan was to create awareness of the new curriculum and provide information about inservice activities at a short faculty meeting two to three months before inservice. Subsequently, three full-day released-time inservice sessions were planned for teachers in each

phase over a nine-month period. These inservices provided "hands on" experiences with each unit in the curriculum, plus sessions on such topics as classroom management and discussion techniques. See Pratt, Melle, Metzdorf and Loucks (1980) for more detail.

The framework for the implementation design was the Concerns-Based Adoption Model (CBAM) (Hall, Wallace & Dossett, 1973), a model which views the change process from the perspective of the individual teacher involved. The CBAM is based on the assumption that change is a lengthy, complex and highly personal experience, and that implementation can only be accomplished when the different needs of teachers are met as they emerge.

Two dimensions of the CBAM were utilized in the science implementation. Stages of Concern (see Figure 1) formed the basis for staff development and support activities. Early stages of Awareness, Informational, and Personal concerns (SoC 0, 1, 2), known to be dominant in the beginning of any change effort, were attended to in small, close-knit meetings. Management (Stage 3) concerns, known to emerge during first use, were addressed in the inservice sessions. Because higher Stages of Concern (Stages 4, 5, 6) are known to emerge only with experience and time, if they do, few activities in the implementation were targeted at these concerns. However, several self-paced modules aimed at student-oriented needs (such as implications of Piaget's work for science instruction) were made available during inservice sessions. In general, however, the implementation effort was targeted at lowering Informational, Personal and Management concerns (SoC 1, 2, 3).

Levels of Use (see Figure 2), describing behaviors of teachers as they become increasingly more familiar with and skilled in using a program, provided district staff a tool for goal-setting and informed implementation planning. It

Figure 1

Definitions:

STAGES OF CONCERN ABOUT THE INNOVATION*

0 AWARENESS: Little concern about or involvement with the innovation is indicated.

1 INFORMATIONAL: A general awareness of the innovation and interest in learning more detail about it is indicated. The person seems to be unworried about himself/herself in relation to the innovation. She/he is interested in substantive aspects of the innovation in a selfless manner such as general characteristics, effects, and requirements for use.

2 PERSONAL: Individual is uncertain about the demands of the innovation, his/her adequacy to meet those demands, and his/her role with the innovation. This includes analysis of his/her role in relation to the reward structure of the organization, decision-making and consideration of potential conflicts with existing structures or personal commitment. Financial or status implications of the program for self and colleagues may also be reflected.

3 MANAGEMENT: Attention is focused on the processes and tasks of using the innovation and the best use of information and resources. Issues related to efficiency, organizing, managing, scheduling, and time demands are utmost.

4 CONSEQUENCE: Attention focuses on impact of the innovation on students in his/her immediate sphere of influence. The focus is on relevance of the innovation for students, evaluation of student outcomes, including performance and competencies, and changes needed to increase student outcomes.

5 COLLABORATION: The focus is on coordination and cooperation with others regarding use of the innovation.

6 REFOCUSING: The focus is on exploration of more universal benefits from the innovation, including the possibility of major changes or replacement with a more powerful alternative. Individual has definite ideas about alternatives to the proposed or existing form of the innovation.

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*From: Hall, G. E., George, A. A., & Rutherford, W. L. Measuring stages of concern about the innovation: A manual for use of the SoC questionnaire. Austin: Research and Development Center for Teacher Education, The University of Texas, 1977.

Figure 2

Definitions:

LEVELS OF USE OF THE INNOVATION*

0 NONUSE: State in which the user has little or no knowledge of the innovation, no involvement with the innovation, and is doing nothing toward becoming involved.

I ORIENTATION: State in which the user has recently acquired or is acquiring information about the innovation and/or has recently explored or is exploring its value orientation and its demands upon user and user system.

II PREPARATION: State in which the user is preparing for first use of the innovation.

III MECHANICAL USE: State in which the user focuses most effort on the short-term, day-to-day use of the innovation with little time for reflection. Changes in use are made more to meet user needs than client needs. The user is primarily engaged in a stepwise attempt to master the tasks required to use the innovation, often resulting in disjointed and superficial use.

IVA ROUTINE: State in which use of the innovation is stabilized. Few if any changes are being made in ongoing use. Little preparation or thought is being given to improving innovation use or its consequences.

IVB REFINEMENT: State in which the user varies the use of the innovation to increase the impact on clients within immediate sphere of influence. Variations are based on knowledge of both short- and long-term consequences for clients.

V INTEGRATION: State in which the user is combining own efforts to use the innovation with related activities of colleagues to achieve a collective impact on clients within their common sphere of influence.

VI RENEWAL: State in which the user reevaluates the quality of use of the innovation, seeks major modifications of or alternatives to present innovation to achieve increased impact on clients, examines new developments in the field, and explores new goals for self and the system.

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*From: The Lou Chart: Operational definitions of Levels of Use of the Innovation. Austin: Research and Development Center for Teacher Education, The University of Texas, 1975.

was decided early in the effort that the goal was to have teachers at least at a Routine Level of Use (LoU IVA) at the completion of the implementation.

The reader is referred for more information to articles about Stages of Concern (Hall & Rutherford, 1976; Hall & Loucks, 1978b) and Levels of Use (Hall & Loucks, 1977; Hall, Loucks, Rutherford & Newlove, 1975) and about their utilization in designing the implementation (Loucks & Pratt, 1979; Pratt, Melle, Metzdorf & Loucks, 1980).

Monitoring Implementation

During the course of the implementation effort, three methodologies were used to assess its effects. Stages of Concern and Levels of Use data were collected five times during the three-year implementation. A third methodology, developed by the science department and district evaluators, identified programspecific components and used these as the basis for measuring the extent of implementation in another set of schools.

The next section discusses the measurement procedures and findings that resulted from the three methodologies. Stage of Concern and Level of Use data are reported together, since the sample of teachers was the same; little detail about measurement is provided, since such items as instrument development are discussed at length elsewhere. The use of program components as an assessment device, and the results of this methodology, are discussed in greater depth, since references have limited availability.

Stage of Concern and Level of Use Assessment

Instrumentation and data collection. Stages of Concern data were collected utilizing the 35-item SoC Questionnaire (Hall, George & Rutherford, 1977) and Levels of Use data were collected utilizing a focused interview procedure

(Loucks, Newlove & Hall, 1976). For Levels of Use assessment, to be considered a "user" of the revised science program (LoU III and above), a teacher had to utilize the teacher's guide to teach at least 80% of the science units. This was considered minimum use. Both concerns and use were collected twice a year for the first two years and once at the end of the third year of the effort. A sample of nineteen schools were selected to represent different phases of implementation. All teachers of grades three through six were included initially, and these same teachers were followed through the final year.

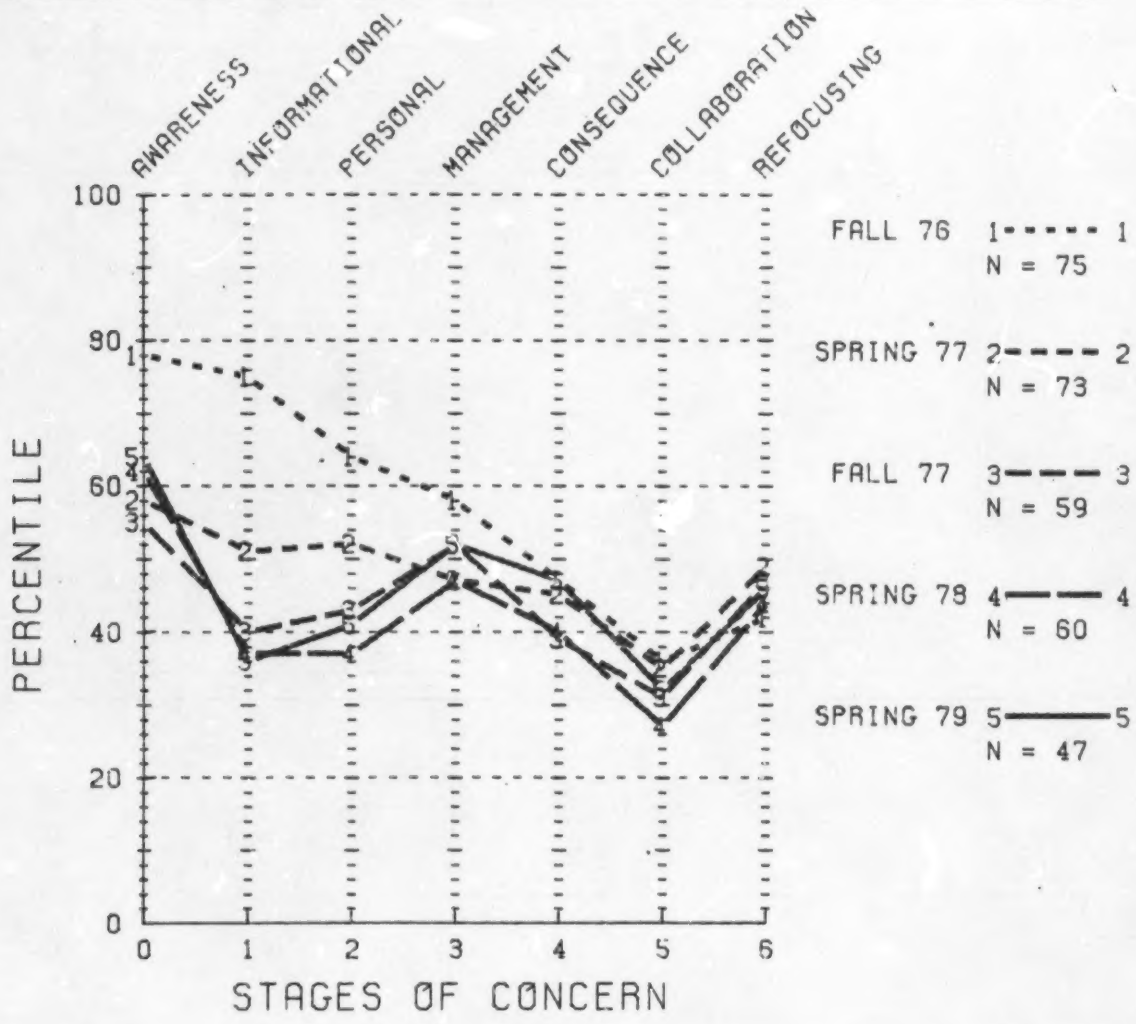
Findings. How did the concerns of teachers about the revised science program change over time? Figure 3 presents concerns data for teachers from a sample of Phase I schools (data are presented by phase since implementation activities were timed differently for different phases). The first measure of concern, fall, 1976, occurred before any inservice activities. Note that concerns are highest at the lower stages, SoC 0, 1, and 2. This is typical of nonusers. By spring, 1977, after two days of inservice training and beginning use of the new curriculum, Stages 0 through 3 have dropped in intensity, with no increases except in Refocusing (SoC 6) concerns. In both fall, 1977, and spring, 1978, the highest Stage of Concern is Management (SoC 3)[3], with Refocusing (SoC 6) concerns still high. This trend continues through another year as spring, 1979, data illustrate.

The bottom of Figure 3 displays LoU data for Phase I teachers. Note that these teachers shifted from predominately LoU II Preparation (fall, 1976) to LoU

[3]The consistently high Stage 0 scores evident in this study are interpreted to mean that this science curriculum was not viewed as a major change by the teachers responding. See Hall, George & Rutherford, 1977, for special interpretation of Stage 0 scores.

Figure 3

STAGES OF CONCERN AND LEVELS OF USE DATA FOR PHASE I SCHOOLS



LEVELS OF USE DISTRIBUTION

	0	I	II	III	IVA	IVB	V	VI	
FALL 76	5	9	83	1	1	0	0	0	N = 75
SPRING 77	0	4	9	53	24	7	1	1	N = 74
FALL 77	3	3	5	38	35	0	13	3	N = 63
SPRING 78	2	3	2	42	34	13	3	2	N = 62
SPRING 79	6	0	2	23	52	13	0	4	N = 52

PERCENT AT EACH LOU

III Mechanical Use (spring, 1977) in the first year. By fall, 1977 (one year after introduction of the program), there is some decrease in the proportion of Mechanical users to users at Routine and higher levels. In spring, 1978, there are still a significant number of teachers at LoU III Mechanical Use. By the final data collection period, two and a half years after initial inservice, a majority of the teachers are at the Routine level, LoU IVA.

Figure 4 displays data for teachers from a random sample of Phase II schools, as a point of contrast to Phase I teachers. Note the major differences: in fall, 1976, Stages 0-2 of Phase II teachers were higher than Phase I teachers; Stage 6 concerns were never as pronounced in Phase II teachers. By spring, 1978, Consequence concerns (SoC 4) predominated in Phase II teachers, while Management concerns (SoC 3) predominated in those at Phase I. By the next year, Management concerns (SoC 3) had decreased even further, and Refocusing concerns (SoC 6) increased to become even with Consequence concerns (SoC 4).

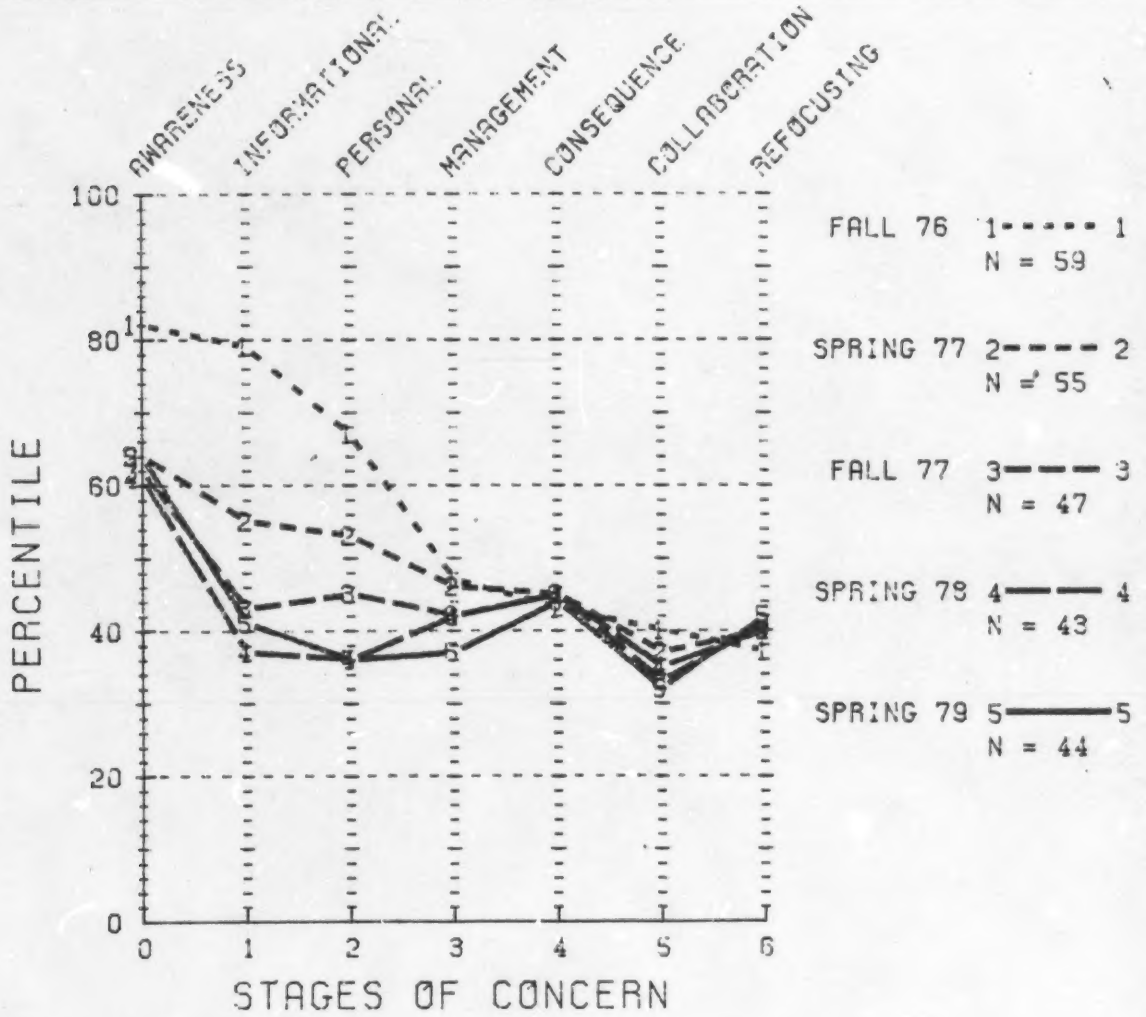
Level of Use data displayed at the bottom of Figure 4 reflect the fact that inservice activities for Phase II came several months after those conducted for Phase I teachers. Note that in spring, 1978, Levels of Use for Phase II teachers still were predominately at LoU III Mechanical Use. By spring, 1979, Levels of Use began to predominate at Routine level and higher.

The changing concerns of Phase III teachers are displayed in Figure 5. These teachers did not begin inservice until January, 1978, which explains the high Stage 0, 1, and 2 concerns during the first three data collection periods. Only in spring, 1979, did these lower stage concerns decrease significantly. At this time, Consequence concerns (SoC 4) emerged as highest.

Phase III use data (see bottom of Figure 5) indicate no significant use of the program until spring, 1978, following shortly after their first inservice.

Figure 4

STAGES OF CONCERN AND LEVELS OF USE DATA FOR PHASE II SCHOOLS



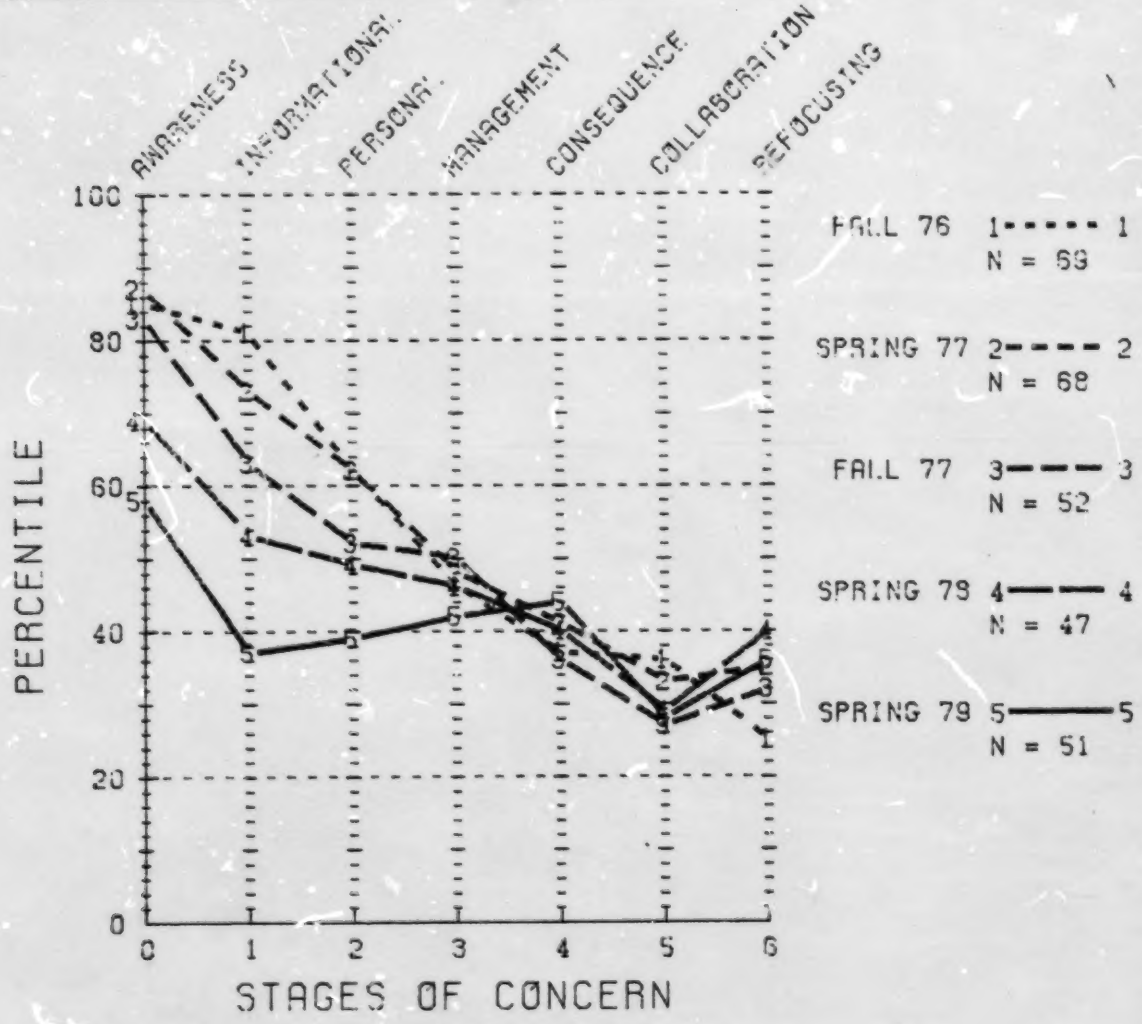
LEVELS OF USE DISTRIBUTION

	0	I	II	III	IVA	IVB	V	VI	
FALL 76	53	3	17	5	17	5	0	0	N = 60
SPRING 77	7	5	43	19	21	3	0	2	N = 58
FALL 77	4	11	11	40	23	6	4	2	N = 53
SPRING 78	9	2	2	44	24	16	0	2	N = 45
SPRING 79	5	0	2	40	40	12	0	2	N = 43

PERCENT AT EACH LOU

Figure 5

STAGES OF CONCERN AND LEVELS OF USE DATA FOR PHASE III SCHOOLS



LEVELS OF USE DISTRIBUTION

	0	I	II	III	IVA	IVB	V	VI	
FALL 76	80	14	1	3	0	0	0	1	N = 69
SPRING 77	66	3	24	6	0	0	0	1	N = 70
FALL 77	12	16	63	4	6	0	0	0	N = 51
SPRING 78	8	14	6	42	22	4	2	2	N = 50
SPRING 79	16	2	0	25	41	12	2	2	N = 51

PERCENT AT EACH LOU

At that time, use was largely at the Mechanical level. One year later, however, the majority of users were at Routine or higher levels.

Discussion of concerns and use findings. The science implementation effort was designed to resolve early concerns at Stages 0-3 and facilitate the development of Routine (LoU IVA) use. Phase I teacher data indicate that Stage 1 and 2 concerns were largely resolved by the spring of 1979, (sixteen months after the first inservice), but Stage 3 (Management) concerns remained high. The high Stage 6 (Refocusing) concerns in conjunction with Stage 3 (Management) concerns suggest that teachers were still uncomfortable with their management problems and had (or were looking for) better ways of teaching the science curriculum. Level of Use data indicate that, after three years, most teachers had routinized their use of the program.

Similarly, the Stage 1 and 2 concerns of Phase II teachers were greatly decreased in intensity by spring, 1979. However, in contrast, Phase II teachers showed Consequence concerns emerging over Management concerns. Here, too, most of the teachers had reached a Routine level. Similarly, although somewhat behind, Phase III teachers' lower stage concerns had been resolved and Consequence concerns were emerging as dominant. As in Phases I and II, Routine use had been reached by a majority of the teachers.

Two trends in these data are notable. First, concerns and use changed in the hypothesized direction. Lower Stages of Concern were resolved over time, and relative to these lower stages, higher Stages of Concern were aroused. Levels of Use increased, with a majority of users reaching Routine level or above by the third year of data collection. This could be characterized as a "normal" evolution of concerns and use during the course of an implementation (Hall & Loucks, 1978).

The second trend is somewhat more subtle, and is characterized by differences between phases. After inservice training, Management concerns always dominated in teachers of Phase I. Management concerns never dominated in Phase II teachers, and in Phase III, Management concerns diminished and Consequence concerns emerged as highest.

There are several possible explanations for these differences. First, with the large amount of materials and equipment, as well as required behavior change, one would expect high Management concerns from all groups. The fact that these lingered only in Phase I teachers may attest to the fact that facilitators, over time, may have improved in their skills in supporting implementation. Phase II and III teachers received more on-target assistance, more timely delivery of supplies and equipment, and more practiced, refined inservice training. Another explanation for why Phase II teachers' Management concerns never dominated lies in the difference between these teachers and those in Phase I and III schools. Phase II schools are on year-round calendars and are thought generally to be more "progressive," innovative schools in the system. Flexibility and team work are demanded by the situation. These schools are also located in growing parts of the district and tend to have younger staffs. Thus, teachers in these schools may have taken the science revision much more "in stride," or compared to all the other logistical manuverings required of them, they may not have felt very bothered by the new demands. Conversely, teachers in Phase I and III schools, which are more "settled," may have perceived the changes as more of a hassle.

The Levels of Use differences are also interesting. Most outstanding is the fact that Phase III teachers moved to Routine use in a year less time than those in Phase I. This, again, may be due to better implementation assistance

and support. In addition, one reason why Phase I teachers took as long as they did was that there were major grade level shifts in teachers' grade level assignments in Phase I schools between years 1 and 2. This meant teachers were teaching new units for which they lacked inservice training and experience. Phase III teachers did not experience such major shifts in grade level assignment.

Why, after two years, are such a significant number of Phase II teachers still at a Mechanical level? Perhaps another characteristic of the innovative Phase II schools, multi-age grouping, contributes to this situation. A management procedure followed in multi-age schools is for teachers to use one grade level's science units one year, and the other grade level's units the second year. Thus, in the second year of implementation, most Phase II teachers were teaching new units -- ones for which they were not inserviced. A situation similar to Phase I schools, but on a larger scale.

It is interesting to note, with all the contextual changes and competing demands on Jefco teachers, that approximately two-thirds of them attained a Routine Level of Use, and managed to resolve most of their lower Stages of Concern. Thus, three years after initiating the implementation effort, the goals of the facilitators had been achieved for most of the teachers.

Assessing Implementation in Terms of Program-Specific Components

The program developers/implementors welcomed Levels of Use assessment as useful in monitoring the early progress of the implementation effort. The time and cost efficiency of its use in a large district made it particularly feasible. For the purpose of the LoU interviews, use of the program was defined as the teacher's use of the district teacher's guide. As there could be many ways teachers could implement the strategies found in the guide, the developers saw a

need for an expanded definition to include other components in addition[4]. This definition needed to be in terms unique and specific to the total science program.

The goal of the science department staff was to enhance science learning for students by implementing teaching practices that would optimize learning. Thus, an operational description was sought to specify what the program would look like when it was implemented in the best possible manner, offering the maximum learning potential. With operational descriptions staff members could monitor the extent of implementation of each of the program-specific components. Staff development strategies could then be introduced which would enable teachers to improve instruction for students.

Twelve components of the elementary science program were identified and described in their ideal form. They clustered in three categories. These components and categories are described in Figure 6.

Instrumentation and data collection. Once the program components were defined, detailed descriptions of each were written in order to measure as objectively as possible the extent to which each component was in place in any one classroom. The behaviors were placed on a 5-point Likert scale: 1--outside the intended program; 2-3--getting a good start; 4--well on the way; 5--best prac-

[4]This effort may have been influenced by the researchers' sharing with the science staff the concept of innovation configurations. Configurations are the different patterns of use that result when individual users vary the components of a program. For information about the concept and identification procedures, see Hall and Loucks (1978a).

Figure 6

COMPONENTS OF THE SCIENCE PROGRAM

I. Program components over which district policy or procedure appear to have the major influence for implementation in the classroom:

1. The recommended percentage of teaching time during the day is devoted to science. An average of 15% of the student's day (10% for third grade) should be devoted to science.

2. Science is taught according to the district guide. During the school year the teacher teaches all units, all objectives of each unit and 90% of the activities.

3. Students' learning is assessed according to the district science guide. According to a review of each unit, the teacher uses the guide assessments with students 85% of the time.

4. Basic skills, as differentiated by the continuum in each curriculum area, are being integrated into the science program. The basic skills keyed in the guide are being introduced or stressed in their subject area time allotment while they are being reinforced during science instruction.

5. The outdoors is used as a classroom when recommended. Whenever outdoor activities are recommended as part of a unit, they are always included.

II. Program components over which the building principal and the teacher both have a major responsibility for influencing implementation in the building and classroom:

6. All materials, equipment and media are available. Appropriate commercial guides and the district guide are available for use. Enough materials are available for individual or small group usage. A storage system of logical sequence is established.

7. Principals have arranged for release of teachers for the total inservice training package and have allocated financial support to the program.

8. Long and short-range planning is evident. The year's schedule is written out and being implemented by the teacher or the team. This schedule reflects attention to seasonal demands, sharing of materials, and maximum utilization of space and personnel. Before each unit is taught, overall planning for that unit takes place.

III. Program components over which the teacher has the major influence for implementation in the classroom:

9. Class time in science is used efficiently and effectively (time on task). At least 75% of the class time is devoted to exploration, pupil interaction, recording data, discussions and listening to each other. An efficient management system for distribution and clean-up of materials is evident.

10. Teacher-student interaction facilitates the program. Using the students' language, the teacher shares with students the objectives of the units. Discussion techniques include: neutral rewarding, wait time, questions above recall level, maximized use of student-student discussion; and data sharing.

11. The classroom environment and arrangement facilitates student-student interaction in small groups. Furniture and materials are arranged in order to facilitate small group interaction. Student behaviors include sharing of materials, listening to each other, working together towards a group goal, and interacting with each other (cooperative learning). Students are task-oriented most of the time.

12. The instruction in the classroom follows the stages of the learning cycle in science: exploration, concept formation, concept application.

tices in operation. An example component appears in Figure 7. Further descriptors are found on data reports, Figures 10 through 14 of the Findings section.

Instruments and data recording sheets for use in monitoring the extent of implementation of the program as defined by the twelve components were developed by the district Department of Evaluation (Darnell, 1979). These included a focused teacher interview, a classroom observation checklist, a focused principal interview, and a focused media specialist interview.

The assessment of implementation took place after the inservice program had been completed during the second year of implementation in Phase I and Phase II schools. (Note that these were not the same schools where concerns and use data were collected.) A random sample of eleven schools was drawn including large, middle size and smaller schools. Two hundred seventy-nine classroom observations were made of ninety-two teachers and 3,114 district students. Sixty-seven percent of these teachers taught a single grade level and thirty-three percent of the teachers a multi-age class. Only ten percent of the teachers were science specialists who taught more than one group of students each day.

Interviews and classroom observations were conducted by specially trained certified teachers and by staff members from the evaluation and science departments. Data collection took place from February through April, 1978, in Phase I schools, and August through January, 1979, in Phase II schools. Each grade three through six teacher who taught science was interviewed extensively and observed for a total science class on three separate occasions. In addition, the principal and library media specialist for each school were interviewed. Complete description and detailed findings for the total study are found in the evaluation report (Darnell, 1979).

Figure 7. EXAMPLE OF A COMPONENT DESCRIBED

2 IS SCIENCE TAUGHT ACCORDING TO R-1 GUIDE ?

OUTSIDE INTENDED PROGRAM 1	GETTING A GOOD START 2 3	BEST PRACTICES WORKING 4 5
A During the school year the teacher covers less than 85% of the objectives and activities. The teacher may or may not cover units in the guide. If units are taught, more activities are omitted than included.	**A** During the school year 85% of the objectives and 85% of the activities are taught. The teacher covers the units as written and spends the allotted time (see #1). Some units may be abbreviated because an extra amount of time was spent on another unit.	**A** During the school year the teacher teaches all units, all objectives of each unit and 90% of the activities. At the end of some objectives teacher uses Optional Activities to extend the unit with small groups of students.
B Objectives or activities are not sequenced. Objectives may be used but teacher-made activities mainly are used to accomplish the objectives.	**B** The teacher can: - Point in the guide to the objective that is currently being taught. - Describe what objectives and activities went before and what objectives will come after current activities.	**B** The teacher can relate what objective is being studied and how the activity pertains to accomplishing the objective. He/she can relate what objectives preceded and will succeed the objective being taught.
C Supplementary media is frequently used in addition to or to the exclusion of hands-on activities.	**C** Teacher uses supplementary media sparingly.	**C** Teacher uses supplementary media sparingly and can demonstrate how supplements which are used support the objectives being taught.

Data were summarized for each teacher across interviews and observations. Each classroom was assessed on every component and a building summary was constructed. Figure 8 represents an example of a building summary sheet.

Presentation and discussion of findings. Figure 9 displays the average extent of implementation for all classrooms for each of the twelve components. In general, in the second year of the implementation effort the program appears to be "getting a good start."

The most successfully implemented components, as indicated by a very low percentage of teachers "outside intended program," were components 6, 7, and 8. There was general agreement by principals and program developers that these components had high priority. Principals realized their influence and monitored these components in their buildings on a regular basis. As an example (see Figure 10), in component 6, dealing with availability and organization of materials, none of the classrooms were outside the program, 52% were getting a good start, and 48% were approaching or had reached "best practices." Similar findings were noted for components 7 (Building Arrangements) and 8 (Long- and Short-range Planning) (see Darnell, 1979).

Looking further at specific components, other patterns emerge. On component 1 (Time is Devoted to Science, Figure 11), the data indicate that 44% of the classrooms received less than the school board recommended portion of the instructional day for science. Slightly over one-half of the classes, 56%, received the recommended allotment of time. Apparently, teachers do not consider science a major instructional concern in a district where basic skills are emphasized. Similarly, component 2 (Use of District Guide) indicated many teachers not teaching a significant portion of the new program, with 38% still "outside the intended program."

FIGURE 8

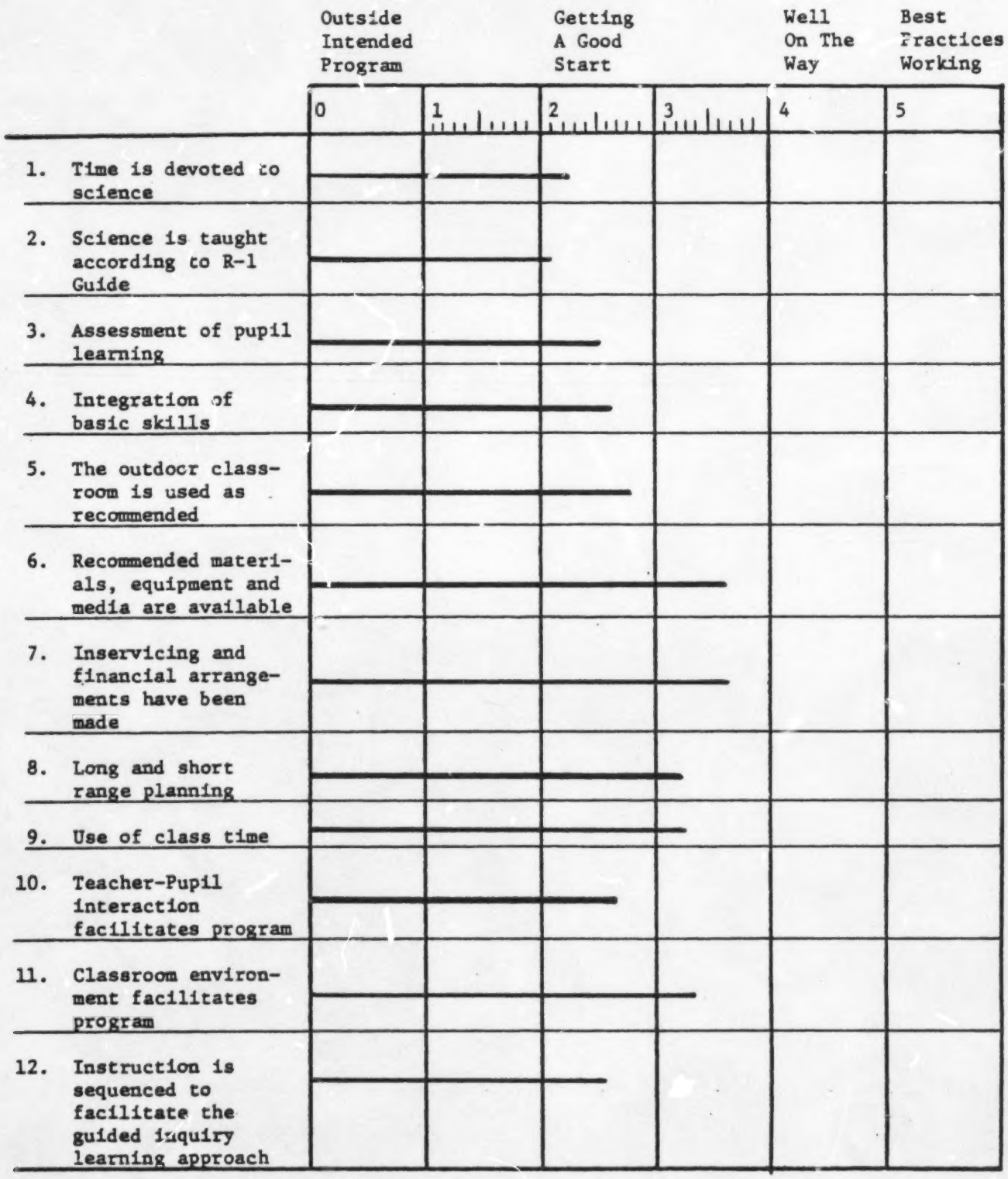
Sample Building Summary Sheet

	OUTSIDE INTENDED PROGRAM	GETTING A GOOD START	WELL ON THE WAY	BEST PRACTICES WORKING
	1	2	3	4	5
1. Time is devoted to science	*** **	*	**	*	**
2. Science is taught according to R-1 Guide	*** ***	*** **			
3. Assessment of pupil learning	*** ***	*** **			
4. Integration of basic skills	*	***** ****	*		
5. The outdoor classroom is used as recommended		*** **	*** *	**	
6. Recommended materials, equipment and media are available			*** **	*** *	**
7. Inservicing and financial arrangements have been made		*	*** **	*** **	
8. Long and short range planning		***	*** ***	**	
9. Use of class time	**	**	****	**	*
10. Teacher-Pupil interaction facilitates program	***	****	****		
11. Classroom environment facilitates program		***	***	***	**
12. Instruction is sequenced to facilitate the guided inquiry learning approach	**	**** *	****		

School Winter Elementary Teacher all 3, 4, 5, 6 teachers

R-1 Program Evaluation
Revised Elementary Science Program Evaluation .1/80

The Average Extent of Implementation on Each Component for All Classrooms

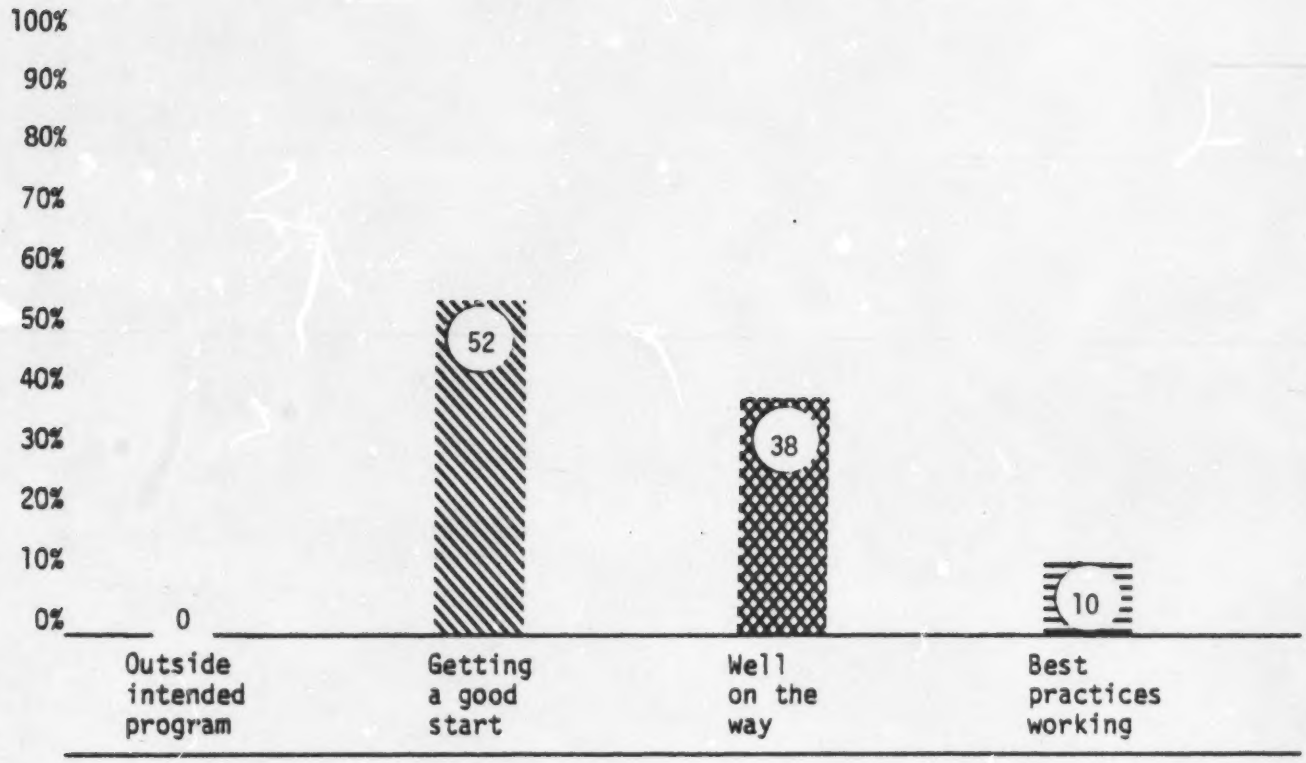

Outside Intended Program
Getting A Good Start
Well On The Way
Best Practices Working
0
1
2
3
4
5
1. Time is devoted to science
2. Science is taught according to R-1 Guide
3. Assessment of pupil learning
4. Integration of basic skills
5. The outdoor classroom is used as recommended
6. Recommended materials, equipment and media are available
7. Inservicing and financial arrangements have been made
8. Long and short range planning
9. Use of class time
10. Teacher-Pupil interaction facilitates program
11. Classroom environment facilitates program
12. Instruction is sequenced to facilitate the guided inquiry learning approach

N = 113

FIGURE 10

PERCENT OF IMPLEMENTATION OF THE REVISED ELEMENTARY SCIENCE PROGRAM FOR COMPONENT #6 IN JEFFERSON COUNTY SCHOOLS, PHASES I AND II

COMPONENT #6. RECOMMENDED MATERIALS, EQUIPMENT AND MEDIA ARE AVAILABLE AND ORGANIZED FOR SMOOTH IMPLEMENTATION.



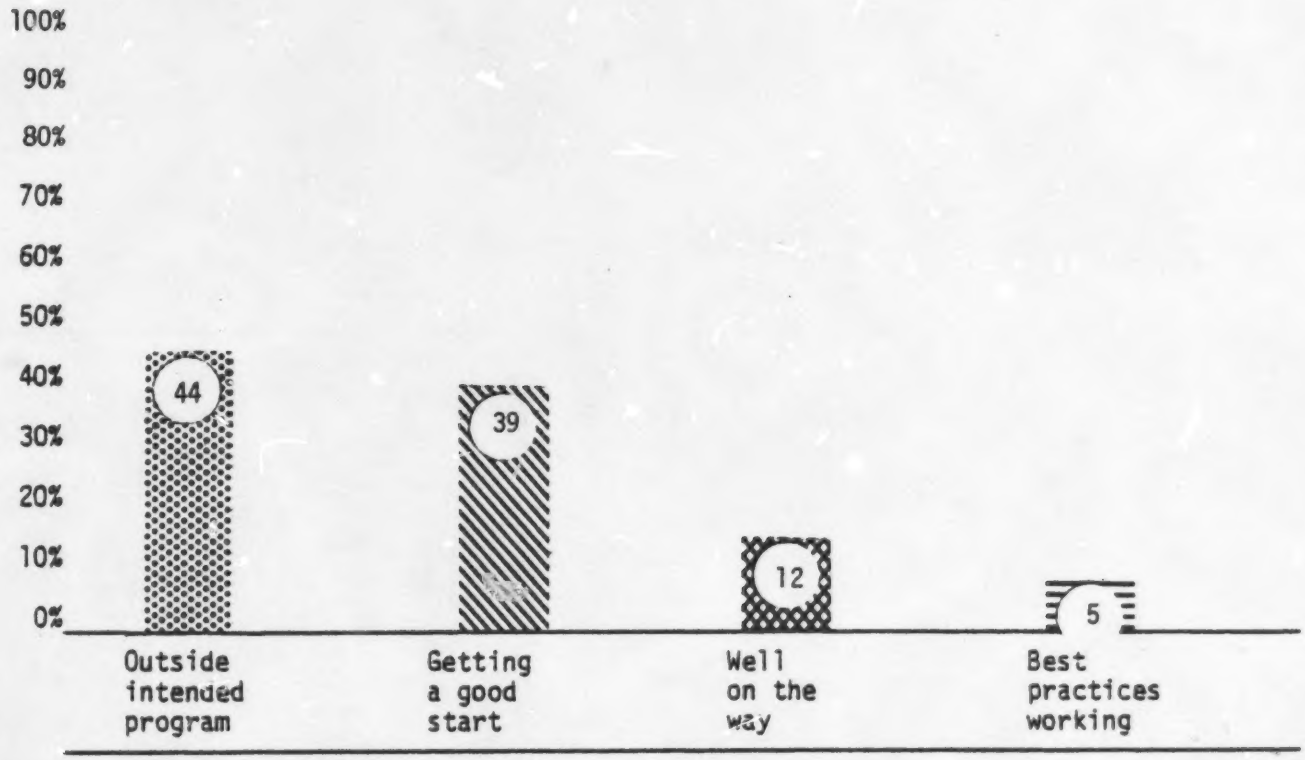
CRITERIA

Outside intended program	Getting a good start	Well on the way	Best practices working
. Current commercial guides unavailable to teachers. . Materials & equipment not available at right time. . Haphazard storage system.	. Current commercial guides and R-1 Guide must be shared. . Teacher aware of plan for making all materials available. . Some storage organization, but not operating smoothly yet.		. All science teachers have commercial and R-1 Guides. . Adequate materials for groups of 3-5 students. . Storage system working smoothly.

FIGURE 11

PERCENT OF IMPLEMENTATION OF THE REVISED ELEMENTARY SCIENCE PROGRAM FOR COMPONENT #1 IN JEFFERSON COUNTY SCHOOLS, PHASES I AND II

COMPONENT #1. TIME IS DEVOTED TO TEACHING SCIENCE



CRITERIA

- Anything less than an average of 12% of the instruction day used for science instruction for grades 4, 5, and 6.
- Anything less than an average of 8% of the instruction day used for science instruction for third grade.

- An average of 12% or more of the instruction day is used for science instruction in grades 4, 5, and 6.
- An average of 8% or more of the instruction day is used for science instruction in third grade.

- An average of 15% of the pupil instruction day is devoted to science for grades 4, 5 and 6.
- An average of 10% of the pupil instruction day is devoted to science for third grade.

"Time on Task," captured in component 9, is discussed in recent literature as a good predictor of student achievement. With so little time each day devoted to science it was important that teachers use it to advantage for students. Figure 12 shows that more than 90% satisfied the minimum criteria and 41% of these were "well on the way" and into "best practices working." It appears that in classrooms little time is spent on materials set-up and clean-up, discipline and teacher lectures. Time is spent on students working with materials individually or in small groups, and in teacher/student discussion.

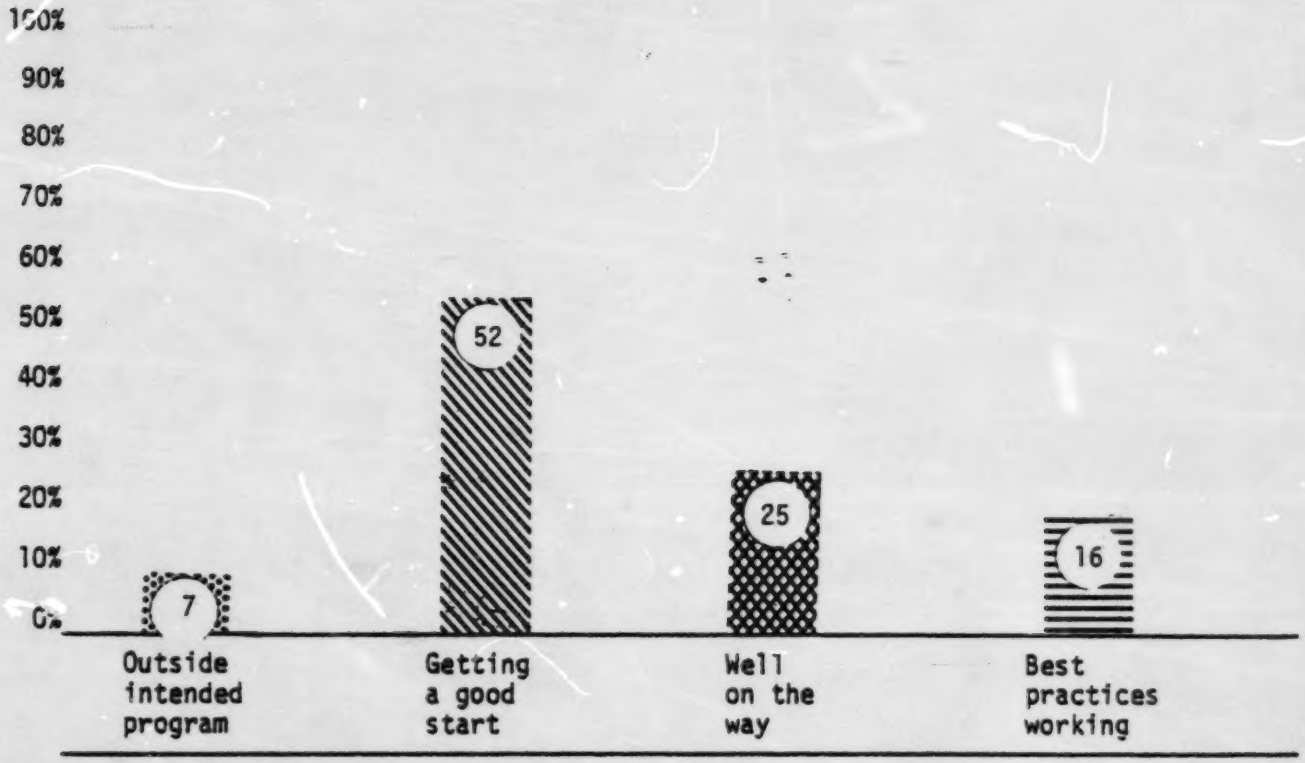
Of the components over which teachers have total control, component 11, "Classrom Environment and Grouping Facilitate the Program Implementation," was the most successfully implemented. It is probably one of the least difficult of the components to put in place, since it deals with the actual physical arrangement of the classroom which enables students to work with "hands-on" and "student-to-student interaction" activities. As displayed in Figure 13, 48% of the teachers were into or approaching the best practices category, with 36% of them getting a good start. The inservice training period for teachers stressed these management techniques, and, as a result, classroom implementation appears to be occurring.

Component 10, "Teacher/Student Interaction Facilitates Implementation," is considered critical to the eventual success of the program for students. The inquiry learning approach upon which the program is based requires from teachers a high level of skills in facilitating experimentation and discussion. Most teachers need a great deal of training and practice in these skills to feel comfortable in their use. Figure 14 shows data to indicate that more than half the teachers observed were demonstrating these skills in a minimal way. The skills were implemented in the consistent "well on the way" manner in only 20% of the classrooms. A very few (1%) exemplary models existed.

FIGURE 12

PERCENT OF IMPLEMENTATION OF THE REVISED SCIENCE PROGRAM
FOR COMPONENT #9 IN JEFFERSON COUNTY SCHOOLS, PHASES I AND II

COMPONENT #9. CLASS TIME IS USED EFFICIENTLY AND EFFECTIVELY (time on task)

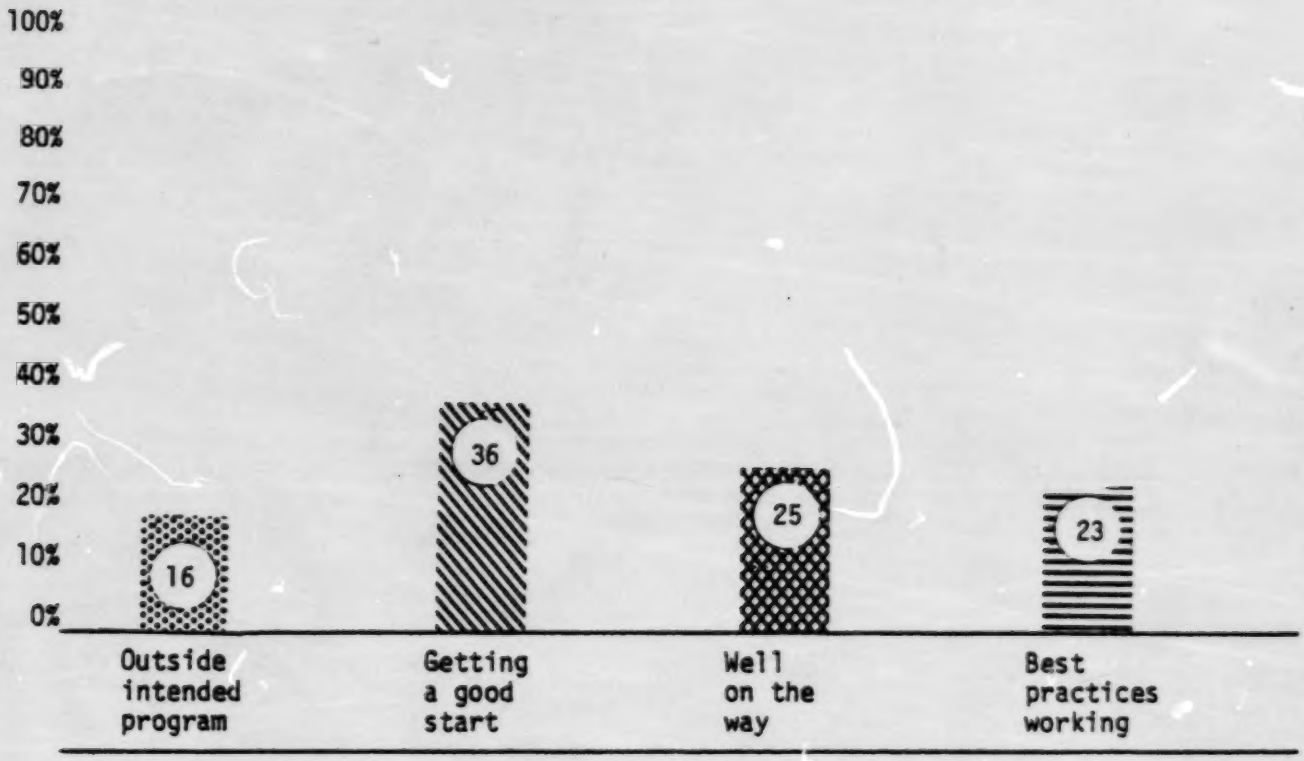


	Outside intended program	Getting a good start	Well on the way	Best practices working
CRITERIA	• More than 40% of class time used for discipline and/or clean up.	• Approximately 60% of class time used for - exploration - pupil interaction - recording data - discussions - listening to each other. • The rest for organization and control, getting ready and clean up.	• At least 75% of the class time is devoted to - exploration - pupil interaction - recording data - discussions - listening to each other. • The rest for organization and control, getting ready and clean up.	

FIGURE 13

PERCENT OF IMPLEMENTATION OF THE REVISED ELEMENTARY SCIENCE PROGRAM FOR COMPONENT #11 IN JEFFERSON COUNTY SCHOOLS, PHASES I AND II

COMPONENT #11. CLASSROOM ENVIRONMENT AND GROUPING FACILITATE PPOGRAM IMPLEMENTATION.



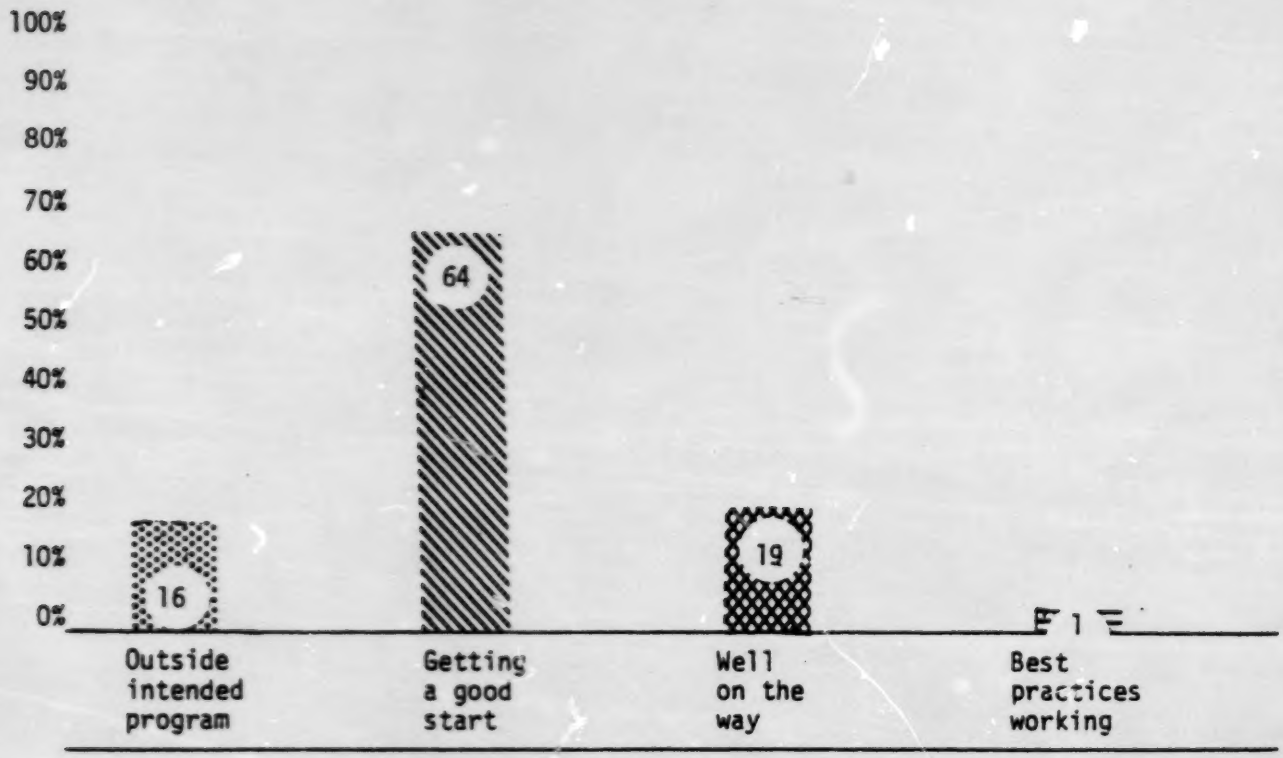
CRITERIA

Outside intended program	Getting a good start	Well on the way	Best practices working
• Desks in rows. • Activities directed to individuals • Teacher dominates. • Students usually not task oriented	• Approaching "Best Practices." • Materials organized for small groups. • Cooperative learning infrequent. • Students task oriented most of time.		• Desks arranged for small group interaction. • Materials organized for small groups. • Cooperative learning is expected. • Students are task oriented.

FIGURE 14

PERCENT OF IMPLEMENTATION OF THE REVISED ELEMENTARY SCIENCE PROGRAM FOR COMPONENT #11 IN JEFFERSON COUNTY SCHOOLS, PHASES I AND II

COMPONENT #10. TEACHER-PUPIL INTERACTION FACILITATES IMPLEMENTATION OF INTENDED PROGRAM.



	Outside intended program	Getting a good start	Well on the way	Best practices working
CRITERIA	• Objectives not shared with students. • No discussions dealing with concept formation are held. • Teacher lectures and asks "fill in the blank" questions. • "Rap session" discussions dominate to the exclusion of activity based learning.	• Objectives shared with students. • Discussions are limited to data sharing. Occasional concept discussions. • Some good discussion techniques are used. • Some questions above the recall level and open ended.		• Objectives shared with students in their language. • Discussion is an integral part of learning cycle. • Discussion techniques include: large/small groups used appropriately, wait-time--neutral reward, divergent questions, "basketball" discussion, etc.

Implications

Summary of Major Insights

Several insights may be derived from the data gathered around the Jeffco science implementation effort. From the concerns and Levels of Use data, it appears that:

1. A change effort that successfully achieves curriculum implementation can be launched across a large school district. In this particular case a "concerns-based" design was effectively utilized, delivering training, assistance and support targeted at different kinds of concerns as they emerged.

2. Successful implementation requires a significant time investment. It took three years before most of the teachers reached at least a Routine Level of Use.

3. The time it takes to successfully implement a program appears to vary with such influences as teacher experience with change facilitator expertise, and grade level mobility. See other papers for identification of other important variables (Hall, Hord & Griffin, 1980; Loucks & Hall, 1979).

Additional insights may be gained from data gathered about specific program components:

1. It is possible to operationally define a program in terms of its component parts, and to derive a measure of implementation using these components.

2. In the second year of the implementation effort, it appears that the teachers utilizing the program were "getting a good start" with all the components.

3. The most successfully implemented components were those to which building principals contributed (#6, 7, 8). The least successfully implemented were those mandated by the district, or those most likely to lack ownership by principals and teachers (#1, 2). Teachers also have success implementing components over which they have complete control and which are management-oriented (#9). They have less success with components requiring orientation to student learning/thinking needs (#10).

Discussion

On the surface, this paper may appear to report two distinct and different studies, similar only in that they focused on implementation of a particular curriculum. However, critical understandings have resulted from the use of three methodologies assessing the impact of the same series of events, and from

the actual process of researcher/practitioner collaboration in facilitating and monitoring a change. These understandings are discussed below:

1. Each different data set had its unique usefulness. Early in the change effort, Stages of Concern enabled specific overview sessions and training workshops to be planned that were targeted directly at answering the questions teachers were asking. Content was adjusted and specific interventions were made based specifically on SoC profile information. Level of Use data were more valuable as a yardstick for assessing regularly how teachers were progressing in their implementation. Was use occurring? If so, with what degree of "mastery?" On the other hand, as initial implementation occurred, district staff needed much more specific information about what teachers were actually doing in their classrooms. Thus, the components were developed not only to assess aspects of the curriculum, but to monitor whether the requirements for implementation (e.g., planning time, equipment) were readily available. The component assessment system became a means to feed back teacher data to principals, in order to assist them in supporting teachers to implement district curriculum (Jefferson County Schools, 1979). Thus, each of the three concepts and their accompanying methodologies had a unique use.

2. The different data sets provide some hints of correlating with each other. Ideally, all three kinds of data should have been collected from the same teachers. This was not done, largely to avoid respondent overload. However, similar trends emerge. Although it is possible to conceive of teachers at any Level of Use implementing components to different extents, it might be hypothesized that teachers with "best practices working," i.e., with highest extents of component implementation, might be at higher Levels of Use. There were some data to support this. Overall, in the second year of implementation, teachers were at a Mechanical Level of Use, and component assessment indicated

they were "getting a good start." One can only guess whether levels higher than Mechanical correlate with higher component scores. This remains for future data collection and analysis.

In addition, it is interesting to note which components appear to have been implemented to the greatest extent: they are those dealing with management of materials, time and students. These are the focus of management-concerned teachers, those at a Mechanical Level of Use. Those components implemented to a lesser extent are those that focus on more subtle student learning needs, and on a commitment to make science a significant learning experience in the student's schooling. These are the focus of impact-concerned teachers, those at Refinement Level of Use and above. Few of these teachers existed in the sample.

3. When is implementation accomplished? That is the question! Four years ago when the collaborative effort began, a large task loomed: to implement a curriculum in 80 elementary schools in a large, diverse district. Goals were set, and four years later have been accomplished. No small accomplishment. Now, the past work appears to have been the easy part. Teachers use the curriculum across the district routinely--they have no very intense concerns. That's good in some ways, but it also means that few of them are concerned about how students learn, how to stimulate inquiry, and how to analyze their own teaching to improve its effect on students. How does one arouse impact-oriented concerns, and once aroused, what interventions are most appropriate to assist teachers in improving student learning? The district has begun piloting some ideas to meet these needs, but such interventions are often labor intensive, costly, and require building-level commitment to provide critical teacher support. The participation of the building principal is required, but adding a facilitator's hat to all of those the principal already wears is no easy undertaking. Acknowledging that principals also have concerns, and that these

need to be taken into account if any change effort is to succeed, is an important insight derived from this effort. A Pandora's box has been opened, and a formidable challenge in understanding how to assist both teachers and principals in the undertaking of school improvement lies ahead.

4. What is this beast called 'collaboration?" Papers, articles, books are written on the subject. The lack of either "useful" research or research being put to practical use underlies the need for more cooperative efforts between researchers and practitioners. Four years of Jeffco/UTR&D collaboration have resulted in the development of strong professional and personal relationships. It's impossible and unnecessary to say who has done what, whose results are whose. We know we all have benefited.

Perhaps the CBAM can help us reflect on how successful collaborative relationships develop over time. Truisms like "trust-building" and "shared decision-making" don't capture what really happens. Rather, we all started with Informational and especially high Personal concerns. "How does a large school district function?" "What exactly is research?" "Can I be relevant to school people?" "Will I need to remember my statistics?" "They just don't understand The Model!" "They're writing down all the mistakes I'm making!" "You're telling me what to do in one of my schools?" Management concerns followed (although Personal concerns never completely disappeared). "Why don't we ever get the data soon enough?" "Why don't all the schools expect us when we arrive to collect data? In any collaborative effort it is critically important to acknowledge these emerging concerns and deal with them as legitimate. Hopefully, this sensitivity allowed us to proceed and contribute some understandings about school change.

Maybe it's the result of aging, or just living through it, but impact concerns are dominant now. Why else spend time in a Copper Mountain ski lodge

writing an AERA paper, when everyone else is skiing? Why live out of a suitcase more than we'd like to so that we can share with other school people, researchers and evaluators what we've learned and how they can help us learn more?

One sign of good research is that it stimulates more questions than it answers. It is our hope that the Jeffco/R&D Center collaboration will be a building block to more and better efforts to focus practitioners and researchers on critical factors and processes that affect the improvement of schools.

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